RESTRICTED

Serial Nº 20559

OPERATING MANUAL

FOR

ARMY MODEL SCR-515-A

AND

NAVY MODEL ABA-1

RADIO EQUIPMENT

Manufactured For

U.S. WAR DEPARTMENT—SIGNAL CORPS

U.S. NAVY DEPARTMENT—BUREAU OF SHIPS

By

GENERAL ELECTRIC COMPANY

BRIDGEPORT, CONN.

ARMY CONTRACT W2124-sc-225

NAVY CONTRACT NOs-82256

ARMY ORDER NO. 1488-PHILA-42

NAVY CONTRACT DATE 22 FEB. 1941

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OPERATING MANUAL

I GENERAL

The ARMY MODEL SCR-515-A and NAVY MODEL ABA-1 are radio equipments designed for aircraft installation. They consist of four major units: the Radio Control Box, which contains the necessary controls for operating the equipment; the Dynamotor Unit, which supplies the necessary operating voltages; two of either type of streamlined Antennae; and the Radio Transmitter-Receiver Unit.

DIMENSIONS AND WEIGHTS

Unit	Height Inches	Width Inches	Depth Inches	Weight Pounds‡
Radio Receiver & Transmitter	$6\frac{1}{4}$	$10\frac{3}{4}$	14	18.7
Radio Control Box	$5\frac{7}{16}$	$5\frac{7}{16}$	$2\frac{3}{4}$	1.59
Antennae (two) ½-wave, dipole	17	$3\frac{1}{8}$	$1\frac{3}{8}$	....1.84
Antennae (two) ¼ Wave	$6\frac{1}{2}$	$3\frac{1}{8}$	$1\frac{7}{8}$	0.94
Dynamotor Unit	$7\frac{1}{16}$	$4\frac{3}{4}$	$13\frac{3}{4}$	11.75
Total (using ¼-wave antennae)*				32.98*
Cables (approx. weight)				23.0
Operating Spares Box	6	18	12	

* Total weight is 0.9 lbs. more when ½-wave Dipole antennae are used.
‡ Weights given are for each unit complete with plugs and mounting plates.

II TO PLACE EQUIPMENT IN SERVICE

1. Procedure:
   - A. See that the Power switch, Receiver switch, and Trans. switch on the Control Box are in the "Stand-By" or "OFF" position.
   - B. Throw the Power switch ON.
   - C. After about a 15 second warm-up period, the Receiver and Trans. switches may be thrown ON.
   - D. See that the "Power On" pilot lamp, and the "Trans. On" pilot lamp are illuminated. For complete operation of the equipment, all three Control Box switches must be in the ON position.
   - E. The Receiver and Transmitter pilot lamp jewels may be turned clockwise for full brilliance.

III OPERATION

WARNING!

THE PUSH BUTTON SWITCH "S" SHOULD NOT BE HELD DOWN, BUT SHOULD ONLY BE DEPRESSED MOMENTARILY, BECAUSE DURING THIS TIME THE RECEIVER SECTION IS TEMPORARILY DISABLED.

DO NOT THROW THE POWER SWITCH "ON" IMMEDIATELY AFTER IT HAS BEEN THROWN "OFF". THROW THE TRANSMITTER AND RECEIVER SWITCHES "OFF" AND ALLOW A MINUTE FOR THE TUBES TO COOL BEFORE THROWING THE POWER SWITCH "ON" AGAIN. THE TRANSMITTER AND RECEIVER SWITCHES MAY THEN BE THROWN "ON" AGAIN AFTER ABOUT A 15 SECOND WARM-UP PERIOD.

1. To insure stable operation of the equipment, a warm-up period of from ten to fifteen minutes is required. The unit will not function at all until the vacuum tube heaters are hot. The equipment will be in operating condition after about a fifteen second warm-up period although it very likely will not be on the correct frequency, inasmuch as it has been aligned after a thorough warm-up period. During this warm-up period both the Receiver and Transmitter frequencies will vary, and this will prohibit long range signaling. How-

ever, during this warm-up, short range signaling may be accomplished only because a very strong off-resonance signal may pass through the system and operate it. Not more than a one or two mile range should be expected under this condition. After ten or fifteen minutes, the equipment will become stable on the frequencies to which it has been adjusted, and long range signaling may be accomplished. Thus to maintain the equipment ready for instant use, it is advisable to leave the Power switch ON during the entire service period that a signal is liable to be sent or received.

2. The operating controls for the ARMY SCR-515-A and NAVY ABA-1 are all located on the Control Box. Each equipment is essentially nondirectional.

3. Procedure:
   A. To transmit a signal, depress the Push-Button switch "S" momentarily. SWITCH "S" SHOULD NOT BE HELD DOWN, BECAUSE DURING THAT TIME THE RECEIVER IS TEMPORARILY DISABLED. If a "Howler" is installed, it will sound during transmission periods, indicating that the equipment is operating.
   B. If it is desired to transmit a succeeding signal, the operator must release the switch "S" and again depress it.
   C. For visual indication of reception, throw the Receiver switch on the Control Box to the "Stand-By" position. In this condition, if a signal is received, the howler (if used) will sound and the WARNING light in the Control Box will flash.
   D. The Trans. switch will usually be thrown to the "OPERATE" position. In the "Stand-By" position, the "Trans. ON" pilot lamp will not light and the Transmitter will be inoperative.
   E. If desired, either one, or both of these switches (Receiver or Trans.) may be in the "Stand-By" position. They are entirely independent of each other.
   F. When a signal is received, the howler sounds, signifying the reception of a signal.

4. Operating Adjustments:
   A. The keying disc is located in the Dynamotor end housing. Two types of keying units are used; known as the "early production", and "late production" types. The "early production" type has the door to the keying unit cut out of the end bell housing, whereas on the "late production" type, the entire end bell housing is hinged as a door.
      (1) To change keying discs on the "early production" type, unlatch the door on the end of the Dynamotor bell housing. Pull out the keying disc retainer spring just enough to clear the top of the disc center pin, and move the spring to the right as far as it will go. The keying disc can then be replaced. The keying disc can fit into the disc holder in only one direction, to insure correct sequence of coding. Replace the retainer spring and snap the cover closed. This entire operation can be done without the use of tools. If no keying disc is used, the circuit will be closed continually. CAUTION! DO NOT PULL THE RETAINER SPRING OUT FURTHER THAN JUST ENOUGH TO CLEAR THE KEYING DISC PIN, OTHERWISE IT IS LIABLE TO BE DAMAGED OR BROKEN.
      (2) To change keying discs on the "late production" type, unlatch the end housing and turn the keying disc retainer latch clockwise about one-quarter turn. Slip off the keying disc and replace it with the desired one. The keying disc can fit into the disc holder in only one direction to insure correct sequence of coding. Replace the retainer latch and snap the end housing closed. The end housing will not close unless the retainer latch is properly reset. This entire operation can be done without the use of tools. If no keying disc is used, the circuit will be closed continually, providing that the retainer latch is reset to its normal position.
   B. To lengthen the relay timing, insert a screwdriver through window T, See Fig. 3, and rotate clockwise. Counter-clockwise rotation decreases the length of time.
   C. The receiver modulated signal sensitivity control is a screwdriver adjustment reached through window MG, See Fig. 3.

Clockwise rotation increases sensitivity, and counterclockwise rotation decreases sensitivity.

D. The receiver over-all sensitivity control is reached through window S, See Fig. 3. Clockwise rotation increases the sensitivity.
NOTE: Whenever this receiver sensitivity control is adjusted, the receiver oscillator tuning (through window RO) MUST be checked immediately.

E. The width switch is a screwdriver adjustment, reached through PW, See Fig. 4. The wide position is with the switch in the clockwise position and the narrow position is with the switch in the counterclockwise position.

IV PRE-FLIGHT TEST

The following procedure should be followed prior to every flight, where the equipment may be put into service:

1. To place equipment in service:
   A. Disconnect plug "D", shown on Figs. 1 and 2.
   B. Throw all three switches on the Control Box to the "Stand-By" or "OFF" position; then throw the Power switch ON.
   C. See that the Power pilot lamp is ON. Wait about 15 seconds and then throw the Receiver and Trans. switches to the "OPERATE" position. See that the Trans. pilot light is ON.

2. Test:
Assuming frequency alignment checks, the following tests are sufficient prior to take-off:
   A. Set the Test Equipment for reception of a signal. After about a 10 minute warm-up period for the equipments, depress switch "S" and check the signal at the Test Equipment for frequency, power and time.
   B. Set the Test Equipment for radiation of a high frequency signal, and check the operation of the SCR-515-A or ABA-1 equipment. Check for audio frequency, radio frequency and power output.

3. Check—Procedure with Army SCR-515-A equipment. (See Fig. 1)
BE SURE PLUG "D" IS DISCONNECTED.
   A. Using Indicator "J", check for absence of voltage across the power supply leads "F".
      (1) Through switch "H"
      (2) Through switch box "G"
   B. Test for full voltage (12 or 24 volts) across the power supply leads F, with the buttons of switch "H" depressed. Full voltage is indicated by maximum brilliance of the indicator lamps.
   C. If the above checks are positive, release the push buttons of switch "H", close the lid, and reconnect the plug "D", see Fig. 1.

WARNING!
DO NOT CONNECT PLUG "D" UNTIL A CHECK HAS BEEN MADE INSURING THAT INDICATOR LAMPS ARE NOT LIGHTED.

   D. Do not shut down equipment, but leave it in operation for service.

4. Check—Procedure with Navy ABA-1 equipment. (See Fig. 2)
   A. Disconnect plug "D" and check with suitable device for absence of any voltage. Do not re-connect plug "D".
   B. Close manually-operated switch "H", checking for voltage in plug "D", and observing appearance of red light on Indicator Box.
   C. Open manually-operated switch "H", and close guard marked "Danger".
   D. Trip the Inertia Switch "G" and check the appearance of red light on Indicator Box.
   E. Turn the slotted head screw on the side of the inertia switch until the pin clicks into vertical position or until the switch is set.

CAUTION: THE INERTIA SWITCH MUST BE SET AT ALL TIMES EXCEPT WHEN APPLYING THE TEST DESCRIBED IN (D).

   F. Reset the Inertia Switch.

Note: Tripping and resetting the Inertia Switch is done in the following way: In order to trip the mechanism, remove the transparent cap by unscrewing it and displace the pendulum arm until a sharp snap indicates that the switch is tripped. In order to reset the switch, insert the blade of a screwdriver into the slotted-head screw on the right-hand side of the switch casing. Rotate the screwdriver counterclockwise as far as it will go, and then allow the screwdriver to be rotated slowly by the spring in a clockwise direction until it catches. The pin seen through the glass cap will be in a vertical position and approximately centered in the ring cast in the top of the glass. If the switch is not in its normal position, the pendulum may have to be held

in place while the screwdriver setting is made.

G. Give the side of the switch a light tap with the knuckles to insure that it is set correctly. The switch should not thereby be tripped; reset if necessary, as described in NOTE under (F). Replace the transparent cap

H. Check for no voltage in the Plug "D".

I. Plug "D" should be reconnected.

5. Navy Model ABA-1 Equipment may be checked with the Model LT Test Equipment. Instructions for this check are contained in the instruction book with the Model LT Equipment.

V BEFORE LANDING PROCEDURE

1. Just before you make a routine landing, perform the following:
   A. Disconnect Plug "D", see Figs. 1 and 2.
   B. Throw the three switches on the Control Box to the "STAND-BY" or "OFF" position.

VI PERIODIC INSPECTION AND TEST

CAUTION: PLUG "D" SHOULD BE DISCONNECTED BEFORE MAKING INSPECTIONS OR TESTS.

1. This section covers inspection and alignment procedures which should be done by the technical maintenance crew assigned to the equipment.

   OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGE WHICH IS DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT SERVICE EQUIPMENT OR CHANGE TUBES UNLESS POWER SWITCH IS TURNED TO "OFF" POSITION.

2. The cable connections should be checked carefully to make sure that the installation is according to the Cabling Diagram, Figs. 1 or 2.

3. The continuity of the antenna systems should be checked and the absence of grounds or short circuits on the inner coaxial conductors, which connect to the ends of the antennae, should be ascertained. Make sure that all tubes are inserted in their proper sockets and that the two acorn tubes have their pointed ends toward each other.

4. With all Control Box switches in the "OFF" or "STAND-BY" position, perform the following:
   A. Disconnect the Dynamotor Unit from the Transmitter-Receiver unit.
   B. Throw the Power switch ON and see that the filaments of all tubes except that of tube VT-191 (316A) light to normal brilliance.
   C. Throw the power switch OFF and reconnect the Dynamotor Unit to Transmitter-Receiver Unit.
   D. Throw the power switch ON and make an over-all check on the operation of the equipment as follows:
      (1) Make sure the Dynamotor Unit is running by listening to it, or by feeling its vibrations.
      (2) See that the Power pilot light is ON.
      (3) Check the Trans. switch on the Control Box and see that the corresponding pilot light illuminates.
      (4) Press the Switch "S" and listen for the relays to operate in the Transmitter-Receiver Unit. These relays should operate with the Trans. Switch either ON or OFF.
      (5) With all switches in the "ON" or "OPERATE" position, the power output of the equipment may be checked by depressing Switch "S" and measuring the output by means of an r-f indicator.

VII ALIGNMENT

The following test equipment is required:

One 0-50 volt d-c voltmeter, 20,000 ohms per volt or better.

One Test Unit, I-86/LU

A suitable signal generator.

1. RECEIVER:

THE FOLLOWING PROCEDURE IS RECOMMENDED ONLY FOR MINOR FREQUENCY "TOUCH-UP". IF THE EQUIPMENT REQUIRES MORE THAN "TOUCH-UP" TUNING, ALIGNMENT MUST FOLLOW THE INSTRUCTIONS GIVEN IN THE MAINTENANCE MANUAL.

   A. Set the controls MG and S (see Fig. 3) to their extreme clockwise position.
   B. Place the Test Unit on the ground about 20 feet in a direct line-of-sight position from the aircraft receiving antenna. Insert the antenna in the Test Unit,

and set the Test Unit to its lower frequency. Throw the switch labelled "Transmitter", on the Test Unit, to "ON".

C. Plug the negative (−) side of the voltmeter in jack MJ (See Fig. 3) and connect the positive (+) lead to ground (chassis). Move the Test Unit farther away, or decouple the Test Unit antenna partially, so that NOT MORE THAN 10 VOLTS is measured by the voltmeter.

D. Put the Radio Transmitter-Receiver unit in operation and allow about 10 minutes before proceeding. Tune the trimmer under window RO for a maximum deflection on the voltmeter. It is always best to start tuning from the extreme clockwise position, and rotate the trimmer adjustment screw counterclockwise, for a maximum deflection on the voltmeter. Then tune the trimmer reached through A (see Fig. 3). Retune RO and "A" for optimum deflection.

E. Repeat the above operation once or twice. This is necessary because changing the tuning of one affects the tuning of the other.

NOTE: Spurious line-up points may be obtained if the adjustment RO is adjusted over too wide a range. The correct point is the one providing maximum deflection of the voltmeter, with the Test Unit suitably decoupled to give not more than ten volts output when properly aligned. If more than slight adjustments are necessary, refer to the maintenance manual. In every case it is important that the adjustment "A" be set initially at approximately 1⅛ turns out from full clockwise rotation.

F. To check the tuning, put the Receiver switch on the Control Box in the "STAND-BY" position, and snap the Test Unit Transmitter switch ON. This should cause the red light on the Control Box to flash. For repeated tests, the Test Unit Transmitter switch must be snapped OFF and ON.

2. TRANSMITTER, HIGH FREQUENCY

A. Next, place the Test Unit and a suitable signal generator on the ground or on the wing, in a direct line-of-sight position from the aircraft receiving antenna.

B. Set the Test Unit to its higher frequency and plug in its antenna and headphones. Throw the Test Unit Transmitter switch OFF, and push the TRANS. switch on the Control Box to "Operate." Tune Adjustment HF (see Fig. 4) until a hiss is heard in the headphones. It is easier to tune the Test Unit for a hiss and note on the Test Unit dial the approximate deviation from the correct frequency. Then turn the adjustment screw HF and retune for a hiss in the headphones. This can be repeated until the unit is on frequency. Recalibrate the Test Unit to check frequency and tune for the middle point of the hiss. DO NOT TUNE FOR A MAXIMUM HISS, BUT TUNE TO THE MIDDLE OF THE HISS BAND. Attenuate the Test Unit signal until hiss covers a narrow portion of the dial, and retune.

3. TRANSMITTER, LOW FREQUENCY

A. Place the Test Unit in line-of-sight with the aircraft, and plug in the headphones and antenna. Calibrate the Test Unit to its lower frequency.

B. Throw the Transmitter Switch on the Control Box to "Operate". Adjustment LF (see Fig. 4) should be tuned for the middle point of the hiss in the headphones of the Test Unit. The switch "S" will have to be depressed repeatedly while making this adjustment, but the tuning cannot be accomplished during the actual time the switch is depressed. After each adjustment, the switch should be depressed and the equipment checked for a hiss in headphones, until it is on frequency. For sharper tuning, attenuation of signal strength may be secured by partially or completely decoupling (pulling-out) the antenna from the Test Unit. Retune for the middle point of the hiss in the headphones.

NOTE: When using the Test Unit, its frequency must be checked frequently to guard against frequency drift.

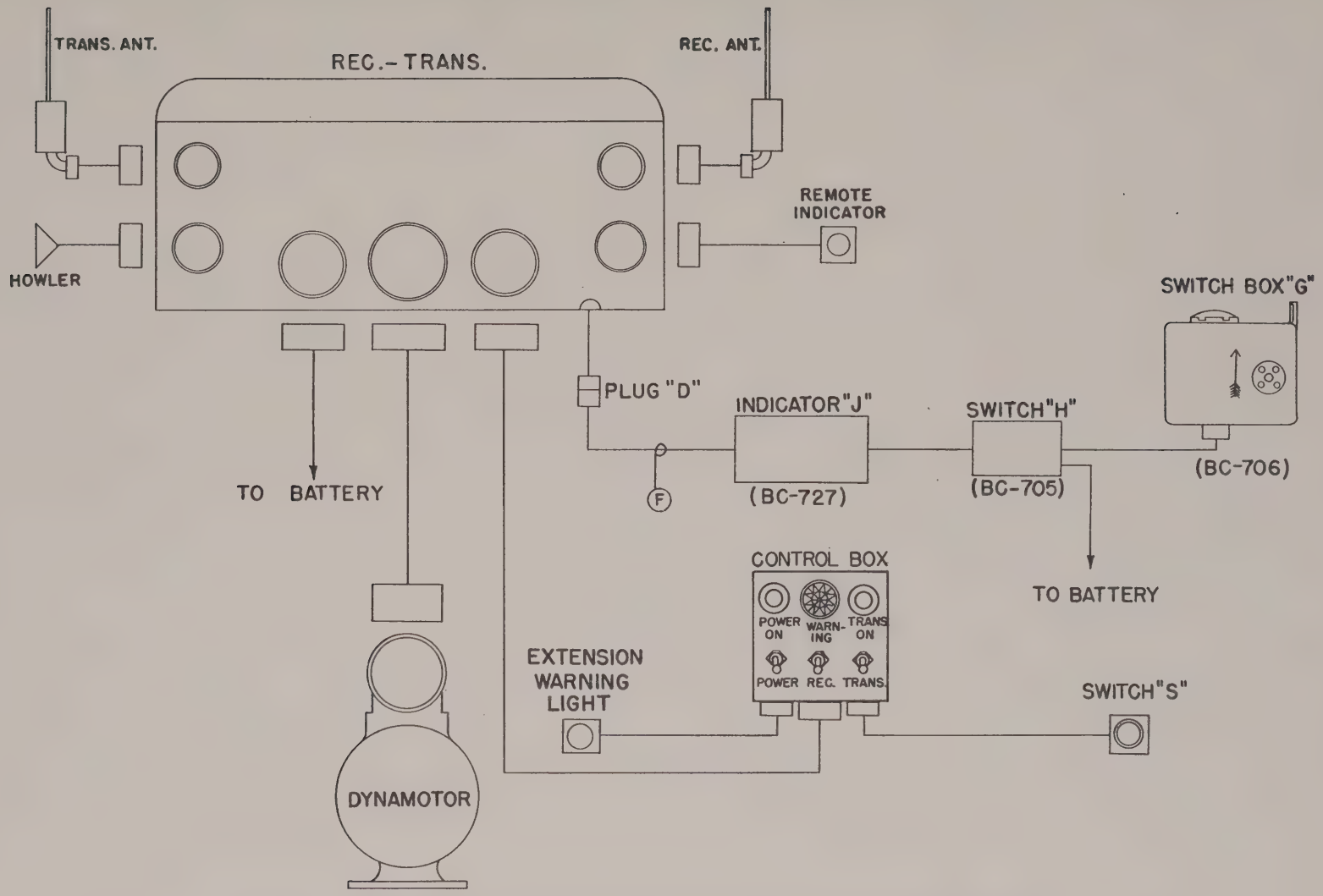

FIG. 1 U.S. ARMY INSTALLATION—SCR-515-A EQUIPMENT

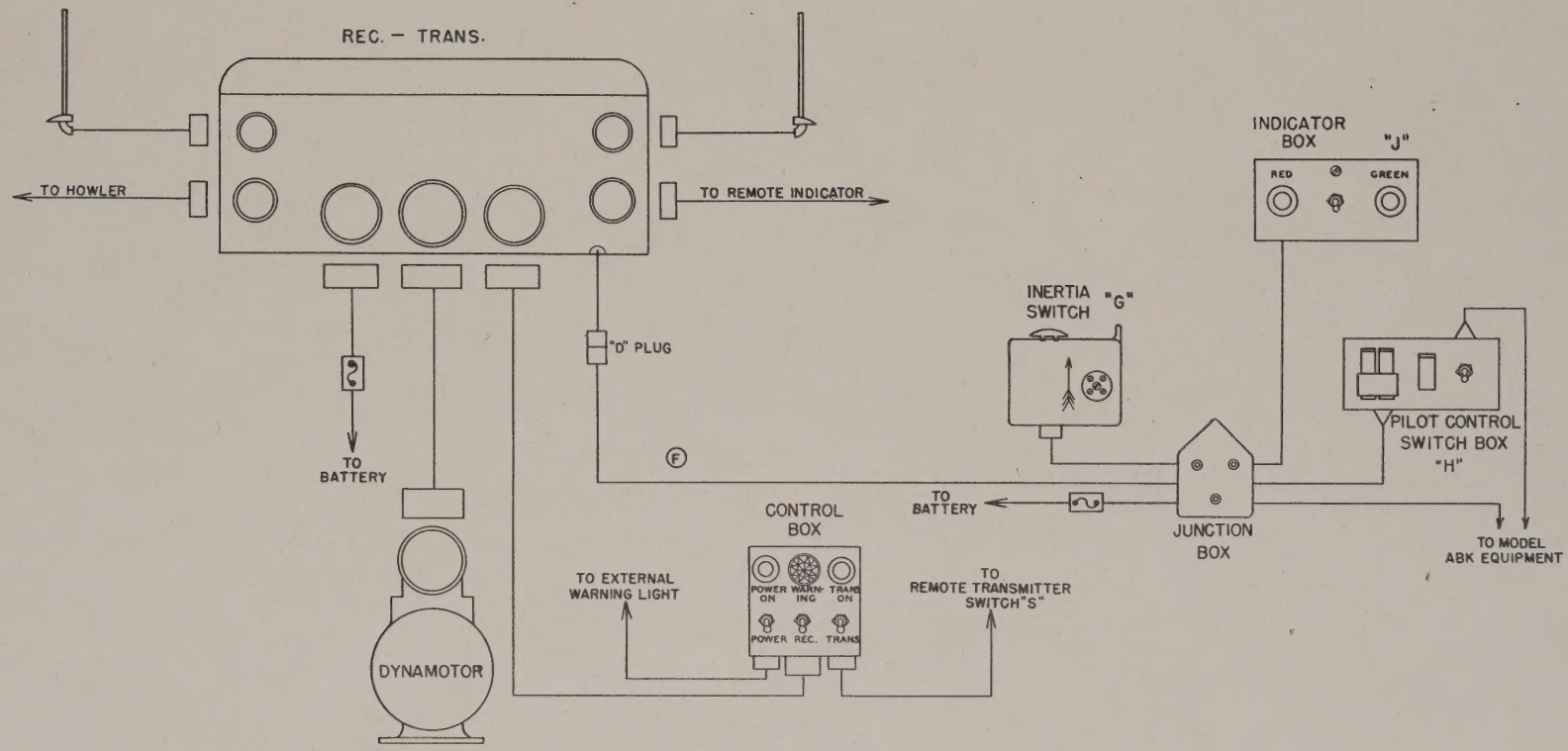

FIG. 2 U.S. NAVY INSTALLATION—ABA-1 EQUIPMENT